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ABSTRACT

The effects of two types of advance organizer small group instruction, expository (EO) and guided self-discovery (GSDO) were assessed in teaching the concrete operational skills of either hierarchical classification or relations to preschool children. A control group was taught using the same materials, in a manner determined by the children's regular teacher. Results indicated that both EO and GSDO groups' posttest performance was superior to that of controls in the area taught (classification or relations), and that posttest performance by EO groups was significantly superior to GSDO. Order of acquisition of logical concrete operations concepts was relations followed by classification. This finding lends support to the asynchronous view of skill development, with classification emerging after, and subsuming relations. In general EO-classification instruction resulted in the greatest amount of transfer of training. Other transfer task trends were also assessed. (Author/MP)

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Effects of Expository and Guided Self Discovery Advance Organizer Lessons on Preschool Children's Learning of Logical Concept

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Abstract

The effects of two types of advance organizer small group instruction, expository (EO) and guided self-discovery (GSDO) were assessed in teaching the concrete operational skills of either hierarchical classification or relations to preschool children. A control group was taught using the same materials, in a manner determined by the children's regular teacher. Results indicated that both EO and GSDO groups posttest performance was superior to that of controls in the area taught (classification or relations), and that posttest performance by EO groups was significantly superior to GSDO. Order of acquisition of logical concrete operations concepts was relations followed by classification. This finding lends support to the asynchronous view of skill development, with classification emerging after, and subsuming relations. Transfer task trends indicated a NN → NF → FF order of transfer effect. In general EO-classification instruction resulted in the greatest amount of transfer of training.

Effects of Expository and Guided Self-Discovery
Advance Organizer Lessons on Preschool Children's
Learning of Logical Concepts

The main aim of this study was to measure the effects of "advance organizer (AO) lessons (Ausubel, 1963; Ausubel, Novak & Hanesian, 1978) on preschool children's reception or meaningful-discovery learning of two "process" concepts (e.g. Lawton, 1977); the intellectual operations of classification and relations (Inhelder & Piaget, 1964). The more specific objectives were three fold. The first and primary purpose was to compare the efficacy of two types of AO presentation in teaching classification and relations; expository versus guided self-discovery. The second purpose was to examine the order of acquisition following training of logical concepts in the concrete operations domain; that is classification, compared to relations. The third and final purpose was to assess the effects of both types of AO on three types of transfer: (1) near-near (NN) - for example, transfer from hierarchical classification learning to a similar task; (2) near-far (NF) - for example, transfer from class inclusion learning to performance on a cross-classification task; and (3) far-far (FF) - for example, transfer from class inclusion learning to performance on a relations or conservation task. Ausubel like other learning theorists, expects the most positive type of transfer to be near-near (otherwise referred to as specific or sequential transfer). Near-far transfer (otherwise referred to as far-transfer or lateral transfer) is not expected to be so easily achieved. Far-far transfer (a more extreme case of far-transfer) is likewise not expected to

readily occur. With respect to the question of order of acquisition of concrete operational skills, and the Genevan assumption of a synchronous emergence of such skills, neo-Piagetian researchers (e.g., Brainerd, 1973; Smedslund, 1963) have generally found asynchronous skill development, with differing orders of emergence. Studies reporting varying degrees of non-specific transfer have been, for example, those of Shantz and Sigel (1967), Sigel, Roeper and Hooper (1966) and Inhelder, Sinclair and Bovet (1974). Studies reporting no non-specific transfer have been Brainerd (1974) Hooper, Wanska, Peterson & DeFrain (1978), and Sigel and Olmstead (1970). Data in general support ease of specific transfer (near-near) and increasing difficulty of non-specific transfer (near-far, far-far). In Ausubel's learning theory, mearningful learning and sequential transfer (specific or near-near transfer) are virtually synonymous.

Advance organizers are deliberately prepared sets of related ideas presented to the learner in advance of and at a more abstract level than subsequent learning materials. The primary purpose of AOs is to insure the learning of relevant "anchoring" ideas to which new knowledge can be related. It is expected that general ideas are retained longer in memory than less inclusive knowledge and have a high degree of generalizability. Ausubel distinguishes between AOs and introductory overviews, or summary materials which are usually presented at the same level of generality as materials to which they are related.

Ausubel distinguishes between two interdependent dimensions of meaningful learning; meaningful reception and discovery learning. In reception learning (associated with expository teaching) the entire

content of what is to be learned is given in final form. In discovery learning (associated with guided self-discovery teaching) the principal content is not given but must be discovered by the learner.

Ausubel assumes the majority of meaningful learning will be reception rather than discovery. Although the young child's learning is dependent upon concrete experience it does not follow that only by making personal discoveries will meaningful learning occur. Ausubel warns that discovery experiences may often result in a lack of understanding of substantive underlying concepts. Young children's spontaneous learning tends in large measure to be intuitive and subjective with a tendency to jump to conclusions and generalize from limited experiences (e.g. Ausubel, 1969; Lunzer, 1973).

Piaget contends that operations cannot be directly taught. If this is attempted, learning is expected to be task specific and non-durable in memory. Operations are integrated concepts internally structured by a self-discovery interaction process between the learner and the environment. Learning is expected to occur slowly over fairly long periods of time.

There has been an abundance of short-term training studies in recent years where attempts have been made to induce concrete operational skills. (e.g. Brainerd, 1972;Brainerd & Allen, 1971; Bruner, 1964; Glaser & Resnick, 1972; Gruen, 1965; Kohnstamm, 1963; Lawton, 1977; Smedslund, 1963; Wohlwill & Lowe, 1962). Though methodology differs, the number of studies reporting significant and enduring training effects can be viewed as indicating the possibility of enhancement or acceleration of concrete operational skills in young children.

Relatively few studies have employed advance organizers with young children. Those worth mentioning have produced differing results concerning the efficacy of AOs as a teaching strategy for young children. Studies by Lawton (1977, 1978), Lawton & Fowell (1979), Lawton, Hooper, Saunders & Roth (1978), Lawton & Wanska (1978), Steinbrink (1971), and Weisberg (1970) have shown positive training effects from AO instruction. Studies in which no significant improvement in performance was reported include those by Barnes (1972), Clawson (1972), Livingston (1970). However, the overall research findings are supportive of the positive learning effects from using AO instruction with young children.

Design and Method

A pretest - training - delayed post-test - transfer task design was used. Pretests were used to establish a sample of 4-5 year old children naive in the use of concrete operations. Posttests were given 6 weeks after training and were immediately followed by transfer tasks. Two forms of AO were used: expository (EO) and guided self-discovery (GSDO). The pre- and posttest battery consisted of classification, relations and conservation tasks. Transfer tasks were cross-classification, cross-seriation and conservation tasks, problem solving tasks, and tasks requiring the application of classification and seriation skills. Children passing on pretests were eliminated. Ss initially failing pretests were allocated to five treatment groups by stratified assignment so that each treatment group was comparable by mean age, and mean pretest score. From an initial random sample of 56 children in three preschools 45 children remained after pretesting. The treatment groups were: expository organizer-classification (EO-C:

age, 50·4 months, range 47-57 months); EO-relations (EO-R: age 53·4 months, range 46-61 months); guided self discovery organizer-classification (GSDO-C: age 51·8 months, range 47-58 months); and, GSDO-relations (GSDO-R: age 55·5 months, range 46-63 months); control (C: age 55·1 months, range 49-63 months).

Test Materials

Pre- and posttests consisted of multiple classification, class-inclusion, additive seriation, one-to-one correspondence. Transfer tasks were cross-classification, cross-seriation, classification and seriation problem solving tasks (child had to recognize the need for classifying and seriating in order to solve two problems), conservation of area and number.

Testing Procedure

For all tasks, children were tested individually. Each task took about 15-20 minutes to complete.

Scoring

Initial raw scores were converted to scores of 0, 1 or 2 according to percentage of correct responses on each task. 25% or less correct responses were scored 0, 26-74% correct were scored 1, and 75-100% correct were scored 2. The 0-2 scale is intended to correspond to: (a) the intuitive stage (score = 0); (b) the transition between pre and concrete operations (score = 1); and, (c) concrete operations (score = 2). These three levels have been used to designate three sub-stages of an "operation" (e.g. Beilin, 1965; Brainerd, 1975).

Teaching Procedure

Teaching sessions were conducted with small groups of four or five children. Experimental groups were taught by the second author and control groups by their regular teachers. Each treatment group received three lessons, related to the objectives of this study, during a two week period. All lessons were tape recorded for later evaluation of their validity. The teaching format for the two experimental treatment groups (i.e. expository-EO; and, guided-self-discovery-GSDO) differed in certain aspects of presentations. Both types of AO presented high-order rules concerning either hierarchical classification or relations. During EO lessons children were directly taught the high-order rules. For GSDO lessons indirect questions, suggestions and prompts were used in an attempt to get children to come to an understanding of the high-order rules.

Teachers of the control group children were unaware of the objectives of the study. They were shown the instructional materials used with experimental groups and were asked: 1. Would you use these materials in your classroom?; 2. How would you use them with a small group of children to introduce ideas about classification and seriation (it was ascertained the teachers knew the meaning of these terms)? The various responses obtained from the two control group teachers were compared. It was found there were no great differences between responses. These teachers were asked to use the materials or construct similar materials. These lesson descriptions were similar to the description of "introductory lessons" used by Ausubel (e.g. Ausubel, Novak & Hanesian, 1978). Such lessons are not expected to result in the same degree of meaningful learning as AO lessons. All lessons took place at the same time of day and lasted the same length of time (25 minutes).

Results

Since all Ss retained from the original sample were those who had been ascertained as naive with respect to classification and seriation, all the analyses reported here were carried out on posttest and transfer data only. The question of type and degree of transfer of learning is of particular interest. In the first place transfer can be associated with the objective of particular AO lessons (teaching superordinate concepts and high order rules about either classification or relations), and in the second place with type of AO instruction (EO versus GSDO). To aid the reader in discerning occurrences of inter and intra concept transfer these are followed by letter identification in parentheses (NN, near-near; NF, near-far; FF, far-far). Identification of transfer associated with type of AO instruction is straightforward.

Posttests. Data from the posttest classification and relations tasks are presented in Table 1. A multivariate test for equality of mean vectors was first carried out on the posttest data. Factors were treatment group (5) x task (8). This analysis yielded a significant overall variance, F (32,123) = 2.46, $p < .001$. A univariance analysis of data from the four classification and four relations posttests was carried out to determine on which posttests the significant variance occurred. Significant differences in performance occurred between groups on: (a) multiple classification, task 1, F (4, 40) = 4.69, $p < .005$, and task 2, F (4, 40) = 4.37, $p < .01$; (b) class inclusion, task 1, F (f, 40) = 3.76, $p < .01$, and task 2, F (4, 40) = 2.64, $p < .05$; (c) one-to-one correspondence seriation, task 1, F (4, 40) = 6.91, $p < .001$, and task 2, F (4, 40) = 7.28, $p < .001$. A series of Scheffe

posthoc comparisons (Scheffe, 1953) of posttest scores revealed that the performance of the EO-C group was significantly better than that of the GSDO-R, GSDO-C, and Control groups on both multiple classification tasks, and class inclusion tasks, (NN). Since neither additive seriation posttest had shown significant variation, no Scheffe comparisons were performed on these tasks. Further Scheffe comparisons showed that posttest performance of the EO-R group was significantly better than the control and the combination of all the other experimental groups on one-to-one correspondence, task 2, and approached significance on task 1 (NN). On one-to-one correspondence task 2 the combined EO-R and EO-C groups performance was significantly better than the Control group (EO-R, NN; EO-C, FF).

Within treatment group ANOVAs for comparison of skill taught yielded the following results with respect to each task: (a) multiple classification - the difference in performance between GSDO-R and GSDO-C was not significant for either task 1 or task 2, while the difference between the performance of EO-C and EO-R approached significance (favoring the EO-C group) on both tasks; NN transfer in each case. (b) class inclusion - no significant differences were found between GSDO-R and GSDO-C on either task 1 or task 2, but on task 1 EO-C versus EO-R yielded a significant difference favoring EO-C, F (1, 16) = 7.58, $p < .05$, and similarly on task 2; F (1, 16) = 10.55, $p < .01$ (NN); (c) additive seriation - no significant differences were found between the performance of any of the treatment groups on either task 1 or 2; (d) one-to-one correspondence seriation - differences in performance between GSDO-R and GSDO-C were not signi-

ficant on either task 1 or 2, but EO-R compared to EO-C approached significance on task 1, favoring EO-R and yielded a significant difference on task 2; $\underline{F}$ (1, 16) = 12.45, $p < .01$ (NN).

A series of ANOVAs were completed on the posttest data for between group comparisons. First, treatment groups combining skill area taught were compared on overall posttest totals. Expository taught groups did significantly better than both controls and GSDO taught groups on posttests tasks ($p < .01$). Next, individual groups were compared on total posttest score performance. Children in the EO-C ($\underline{F}$ (1, 16) = 18.5, $p < .005$) and EO-R groups ($\underline{F}$ (1, 16) = 15.6, $p < .01$) performed significantly better than the C group, as did the GSDO-R group on total posttest scores ($\underline{F}$ (1, 16) = 5.0, $p < .05$). There were no significant differences between the total posttest scores for EO-R compared to GSDO-R. This was also the case for GSDO-C versus control.

Further ANOVAs were performed for posttest scores in particular skill areas to assess inter concept transfer following EO versus GSDO instruction. A comparison of EO-C versus GSDO-C groups revealed a significant difference in classification posttest scores (i.e., all spontaneous classification and class inclusion tests); $\underline{F}$ (1, 16) = 12.23, $p < .01$, favoring the EO-C group. A similar comparison of relations posttest scores for EO-R versus GSDO-R groups (over all additive and one-to-one correspondence seriation tasks) showed no significant differences between the performance of these two groups, though a trend in performance on these tasks favored the EO-R group.

Data from the transfer tasks are presented in Table 2. Of the seven transfer tasks given, only data from the first (i.e., cross-

classification in a 3 x 3 matrix) indicated a significant variance in performance; F (4, 40) = 2.59, $p < .05$. Scheffe posthoc analyses on this task showed that EO-C (NF) and EO-R (FF) groups tended to improve their performance compared to all other groups. This difference approached significance. On transfer task 2 (cross-seriation in a 3 x 3 matrix) the EO-R group's superior performance (NF) over GSDO-C, GSDO-R, and C also approached significance. On the third transfer task (classification problem-solving), the trend toward superior performance favored both expository taught groups (NF and FF) and the GSDO-C group (NF). On transfer task 4 (seriation problem-solving), there was a similar trend favoring both expository taught groups (NF and FF) and GSDO-R (NF) groups over GSDO-C and C groups. From the protocols it is clear that near-far transfer was strongest with some indication of far-far transfer, mainly for EO groups.

The final three transfer tasks dealt with conservation. For these tasks data indicated the least variation in performance of all the transfer tasks. There were no significant differences between identity conservation and equivalence conservation mean scores, although the EO-C group did slightly better than the other groups on identity conservation of area. On the final transfer task, conservation of number, no difference between groups approached significance.

Discussion

The results will be discussed in terms of the three objectives of the study. First, with respect to the relative effect of EO or GSDO advance organizer lessons, posttest data strongly supported the

superior effect of EO instruction (See Table 3a).

The combined classification (EO-C + GSDO-C) and relations (EO-R + GSDO-R) groups did best on their respectively related posttest tasks, but transfer to the opposite set of tasks clearly favored the EO-C + the GSDO-C groups (See Table 3b). These data support the asynchronous skill development argument with relations being acquired sooner than hierarchical classification.(1)

However, following AO-R (particularly EO-R) training, there was some transfer to classification tasks. A more detailed analysis of task structure and demands seems needed in order to more clearly identify transfer effects.

Finally, there is the question of what effects the two types of AO had on types of transfer (NN, NF and FF). Data, pertinent to this question has already been referred to above in the discussion of order of acquisition of classification and relations logical concepts. In that particular case, the strongest transfer effect was NN with the AO-C groups achieving the more positive FF transfer. With respect to the two problem solving transfer tasks (classification and relations) it was possible for both AO-C and AO-R groups to achieve both NN and FF transfer. It was possible for all experimental groups to achieve FF transfer on the conservation tasks. The results indicate that:

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(1) An alternative argument would be that hierarchical classification is more difficult than and superordinate to seriation. Therefore, children trained to use high-order rules for HC would be expected to show more positive transfer to relations tasks than children trained to use high-order rules for relations tasks.

1. (incidentally) EO groups do somewhat better on these tasks than GSDO or C groups; 2. on the problem solving tasks, in general, there was both NN and FF transfer with more positive NN transfer. With respect to the conservation tasks the only clear difference in performance between treatment groups favored the EO-C group and this result suggested some evidence for limited FF transfer in this case (See Table 3c).

It appears from the overall transfer tasks data that, when FF transfer occurs it is more likely to occur for the EO - group in connection with relations rather than conservation tasks.

Conclusions

To summarize the main conclusions of this study: (1) the use of AOs were successful in improving performance on classification and relations tasks; (2) the most efficient presentation method was expository organizers; (3) durability of learning was evidenced by performance on post-tests delayed by six weeks following instruction; (4) the most positive form of transfer was near-near (sequential) followed by near-far.

Where FF transfer occurred it was limited and associated with the EO-C group, mainly on relations tasks. Finally, it is worth mentioning that these results indicate that EO instruction is both a viable and effective means of instructing preschool children in a natural setting.

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Table 1

(a) MEAN SCORES AND STANDARD DEVIATIONS ON CLASSIFICATION POSTTESTS

Classification	Score Range	Treatment Groups				
		EO-C[a]	EO-R[b]	GSDO-C[c]	GSDO-R[d]	C[e]
Multiple Classification Task 1	0-2	1.2(0.6)	0.6(0.5)	0.3(0.5)	0.3(0.5)	0.3(0.5)
Multiple Classification Task 2	0-2	1.3(0.7)	0.7(0.4)	0.5(0.5)	0.5(0.5)	0.3(0.5)
Class Inclusion Task 1	0-2	1.6(0.7)	0.7(0.6)	0.8(0.7)	0.4(0.5)	0.6(0.8)
Class Inclusion Task 2	0-2	1.4(0.5)	0.4(0.7)	0.8(0.7)	1.0(0.7)	0.6(0.7)

(b) MEAN SCORES AND STANDARD DEVIATIONS ON SERIATION POSTTESTS

Relations Tasks	Score Range	Treatment Groups				
		EO-C[a]	EO-R[b]	GSDO-C[c]	GSDO-R[d]	C[e]
Additive Seriation Task 1	0-2	1.3(0.7)	1.6(0.5)	1.0(0.8)	1.1(0.9)	0.6(0.8)
Additive Seriation Task 2	0-2	1.2(0.8)	1.1(0.9)	1.2(0.9)	1.2(0.4)	0.5(0.7)
1:1 Correspondence Seriation - Task 1	0-2	1.5(0.7)	2.0(0.0)	1.1(0.9)	1.5(0.5)	0.5(0.5)
1:1 Correspondence Seriation - Task 2	0-2	0.8(0.6)	1.7(0.4)	0.6(0.8)	1.0(0.7)	0.2(0.4)

[a] EO-C: Expository-Classification (N=9)

[b] EO-R: Expository-Relations (N=9)

[c] GSDO-C: Guided Self-Discovery Classification (N=9)

[d] GSDO-R: Guided Self-Discovery Relations (N=9)

[e] C: Control (N=9)

Standard deviations are given in parentheses.

TABLE 2

MEAN SCORES ON TRANSFER TASKS

Transfer Task	Score Range	Experimental Group				
		EO-C[a]	EO-R[b]	GSDO-C[c]	GSDO-R[d]	C[e]
Cross-Classification 3 x 3 matrix*	0-2	1.2(0.6)	1.4(0.7)	0.6(0.7)	0.8(0.6)	0.6(0.5)
Cross-Seriation 3 x 3 matrix	0-2	1.0(0.8)	0.8(0.7)	0.5(0.5)	0.4(0.7)	0.5(0.7)
Problem Solving: Spontaneous Classification	0-2	1.3(0.7)	1.3(0.7)	0.6(1.0)	1.4(0.8)	0.7(0.9)
Problem Solving: One-to-One Correspondence Seriation	0-2	1.4(0.5)	1.3(0.5)	1.1(0.9)	0.6(0.8)	0.6(1.0)
Conservation of Area: Identity	0-2	0.4(0.8)	1.1(1.0)	0.8(1.0)	0.4(0.8)	0.2(0.6)
Conservation of Area: Equivalence	0-2	0.6(1.0)	0.8(1.0)	0.0(0.0)	0.2(0.6)	0.2(0.6)
Conservation of Number	0-2	0.6(1.0)	0.8(1.0)	0.4(0.8)	0.6(1.0)	0.4(0.8)

* : Significant variance ($p < .05$)

[a] EO-C: Expository-Classification (N=9)

[b] EO-R: Expository-Relations (N=9)

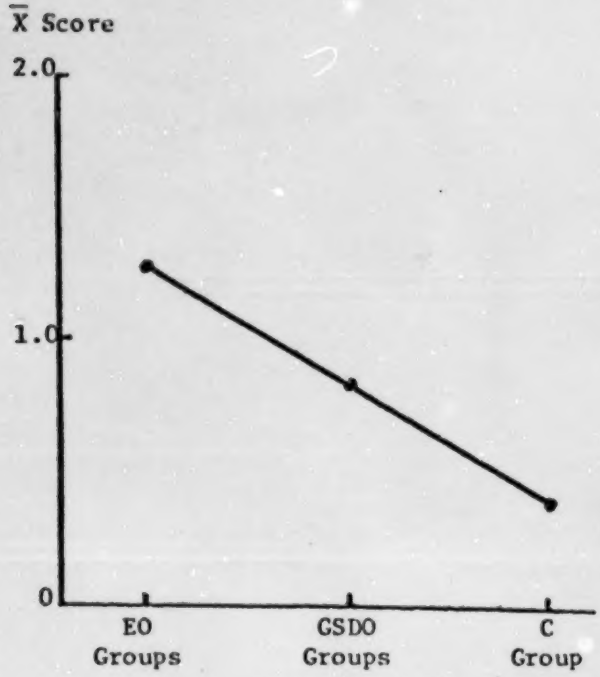
[c] CSDO-C: Guided self-discovery-Classification (N=9)

[d] GSDO-S: Guided self-discovery-Relations (N=9)

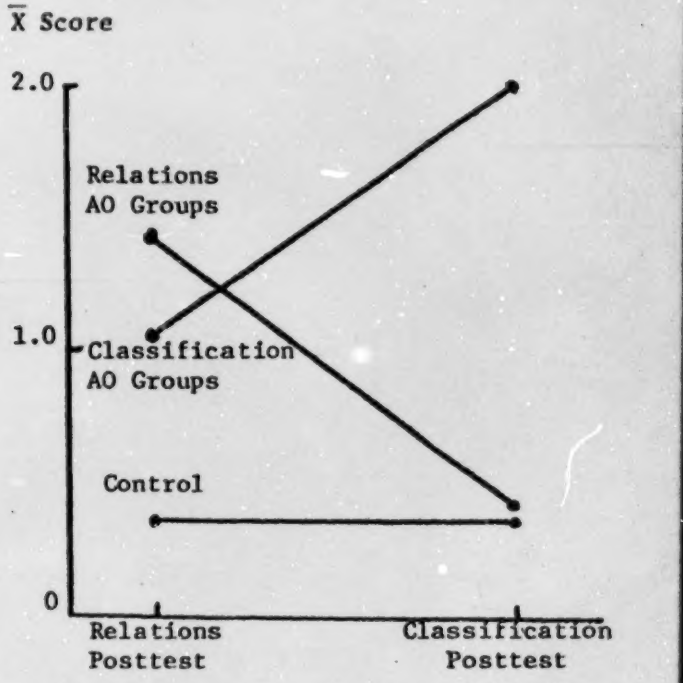
Standard deviation scores are given in parentheses

Table 3

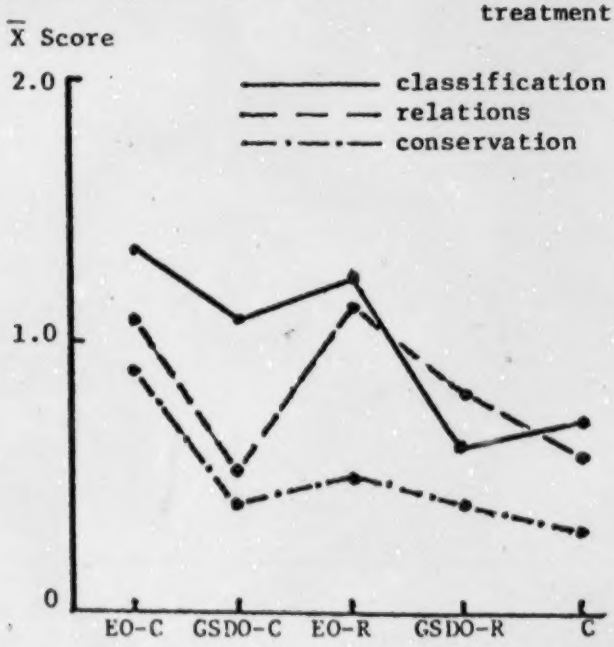
Data Pertaining to the Four Hypothesis



(a) Mean scores for combined posttest by treatment group. (Hypothesis 1 & 2)



(b) Total mean posttest scores on relations and classification tasks for each treatment group. (Hypothesis 3)



(C) Combined mean scores for cross classificatory spontaneous classification problems, cross-seriation, 1 to 1 correspondence problem & conservation tasks (transfer tasks) for each treatment group. (Hypothesis 4)